Session 139

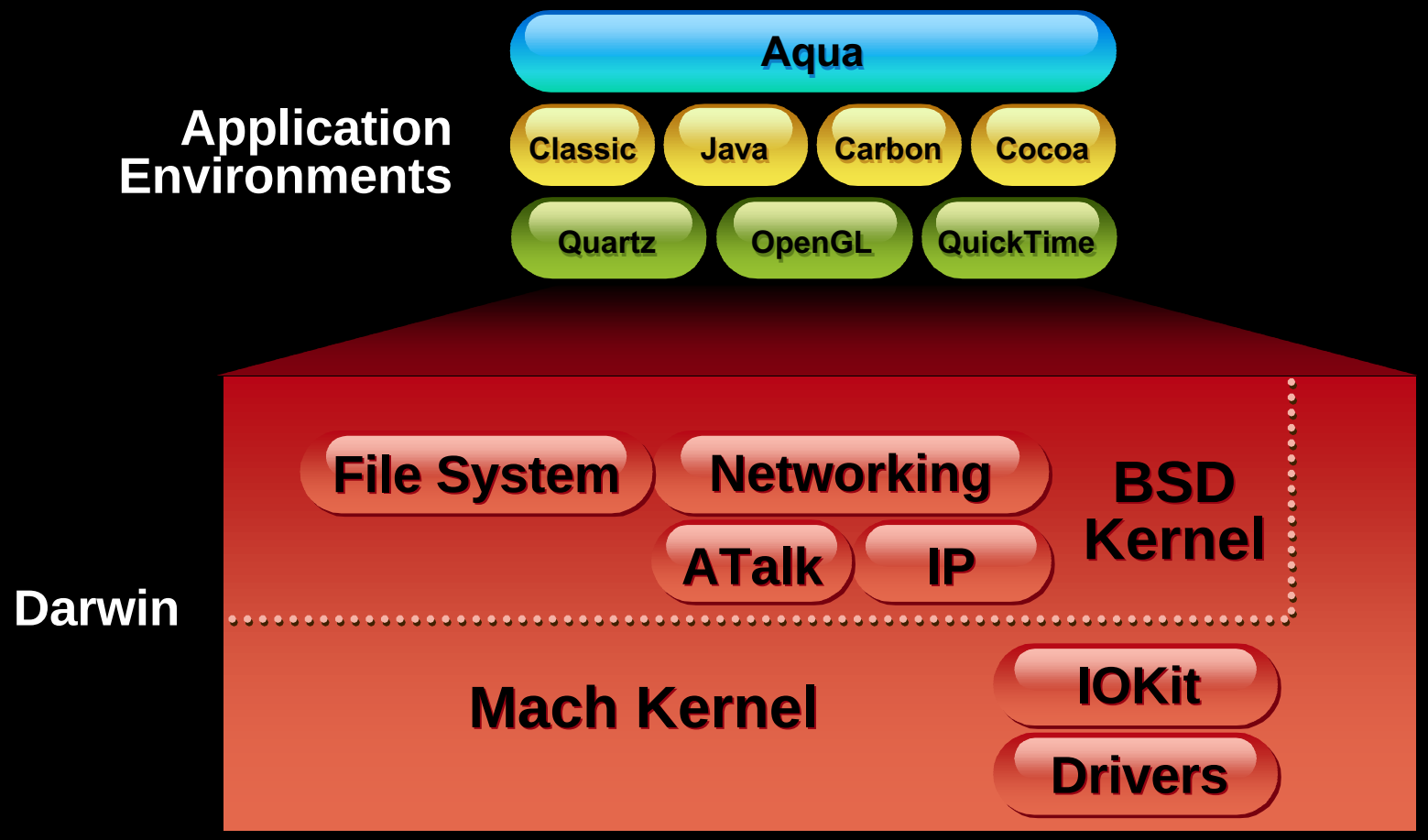
Leveraging BSD Services in Mac OS X

Brett R. Halle
Director, Core OS Engineering

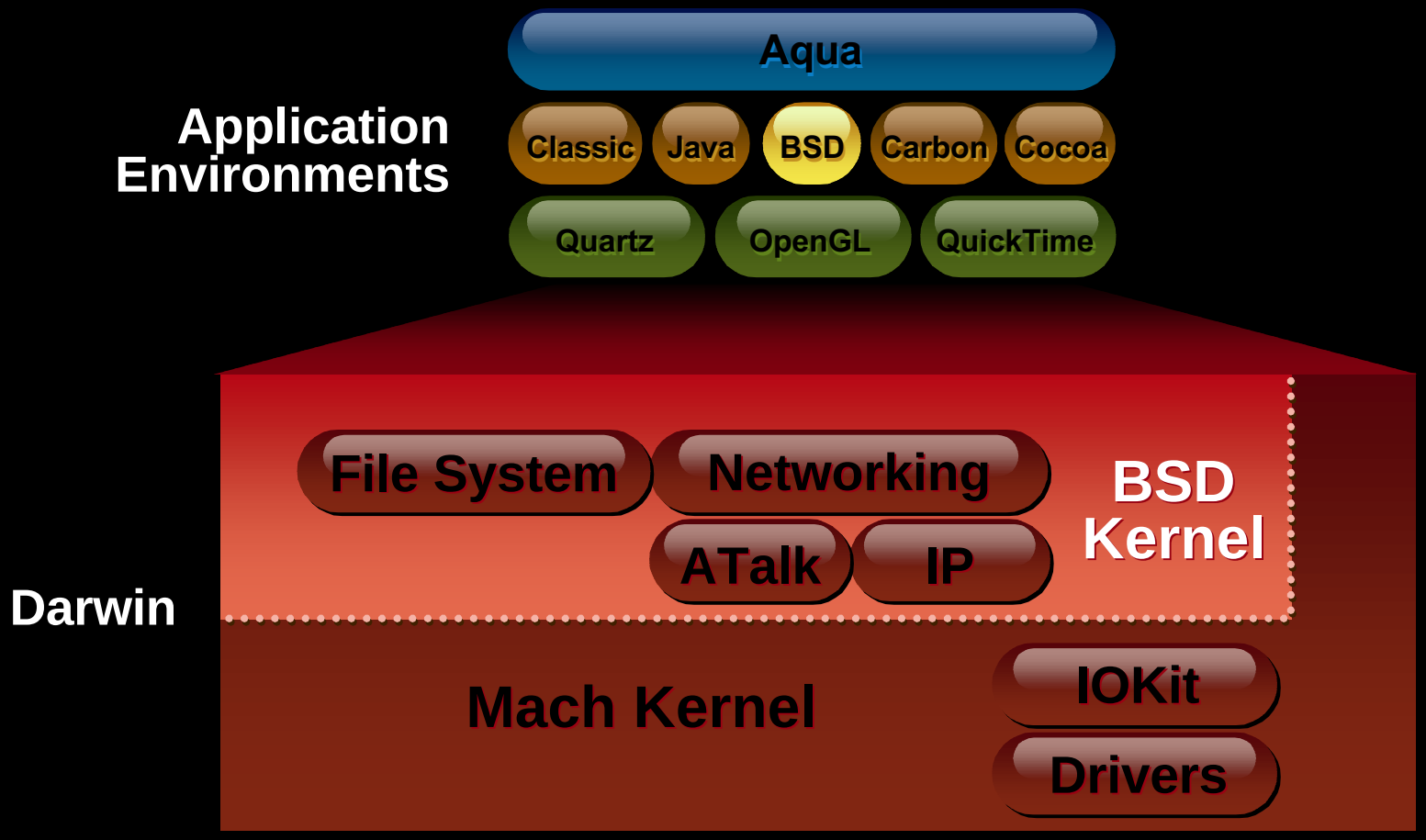
Topics

- What is BSD?
- BSD's role in Mac OS X
- Programming with BSD
- The BSD community

Darwin/Core OS



BSD: The Power of UNIX



The Darwin Kernel

- BSD sits on top
  - File system layer
  - Network stack
  - POSIX functionality
- I/O Kit owns the driver model
- Mach sits underneath
  - Tasks and threads
  - Memory
  - Manages the processor

What Is BSD?

- It's an Operating System!
  - The BSD kernel
  - The BSD libraries
  - The BSD application environment

BSD Kernel

- Based on BSD 4.4 plus integration w/Mach and I/O Kit
- Provides “OS Personality” APIs and Services
  - Process model
  - Basic security policy
  - File system architecture
  - Networking architecture

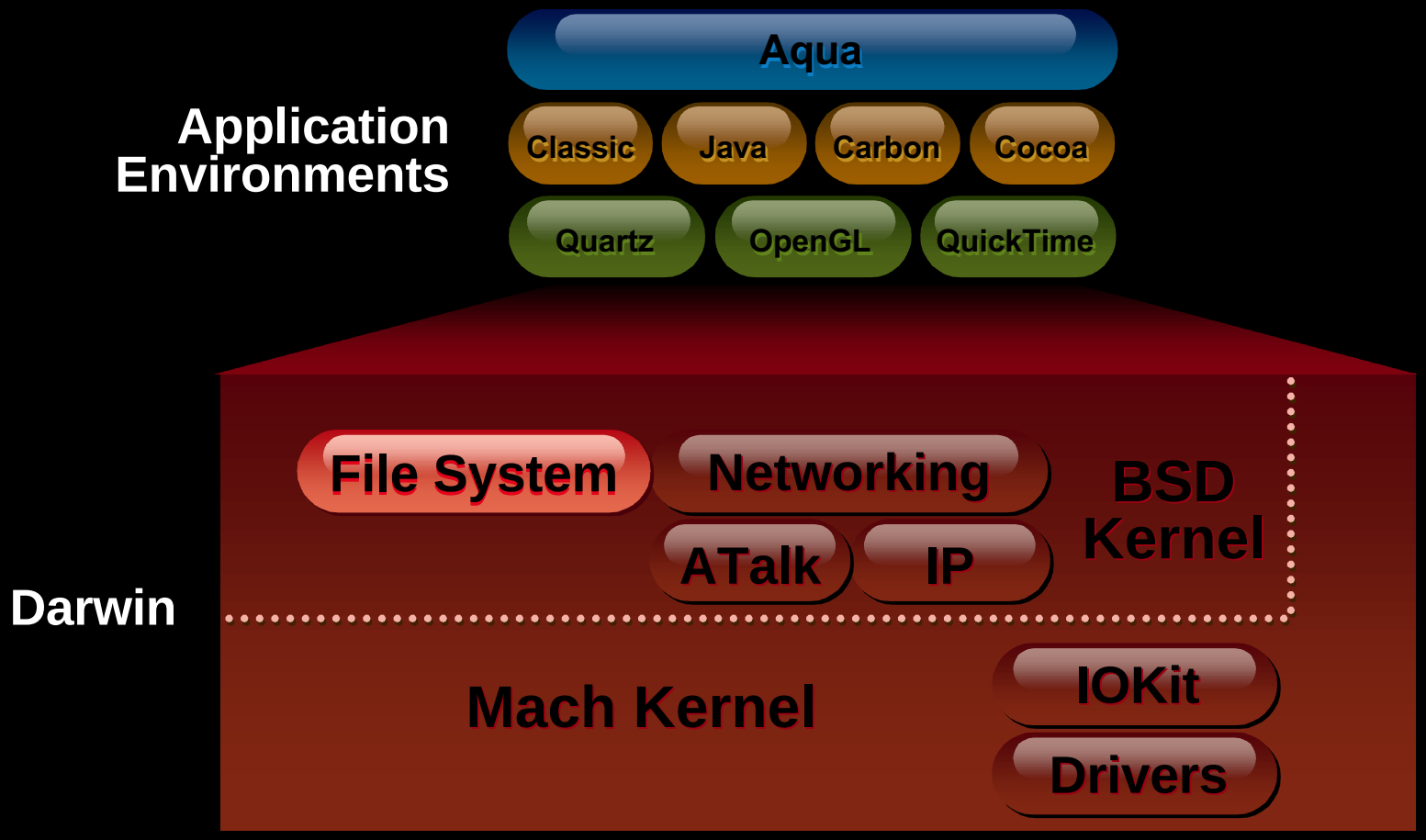
Process Model

- BSD Process vs. Mach Task/Thread
- OS resource management
  - File descriptors
  - Memory
  - Network resources
- Environment variables
- Signal delivery

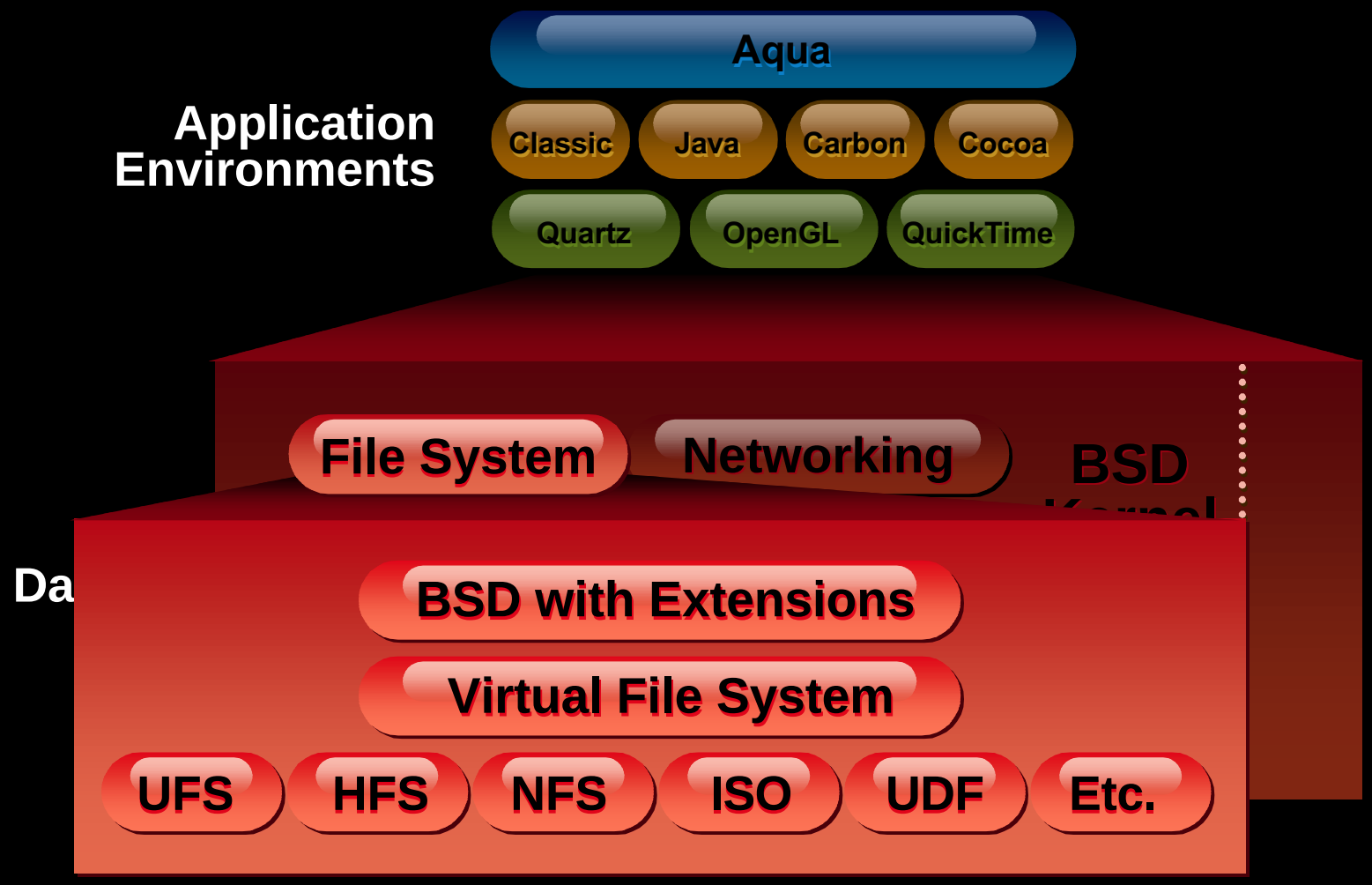
Security Policy

- “Users”
- Super user vs. everyone else
- File system access
  - Users
  - Groups

File System


Aqua
Application Environments
Classic
Java
Carbon
Cocoa
Quartz
OpenGL
QuickTime
File System
Networking
ATalk
IP
BSD Kernel
Darwin
Mach Kernel
IOKit
Drivers

File System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QuickTime
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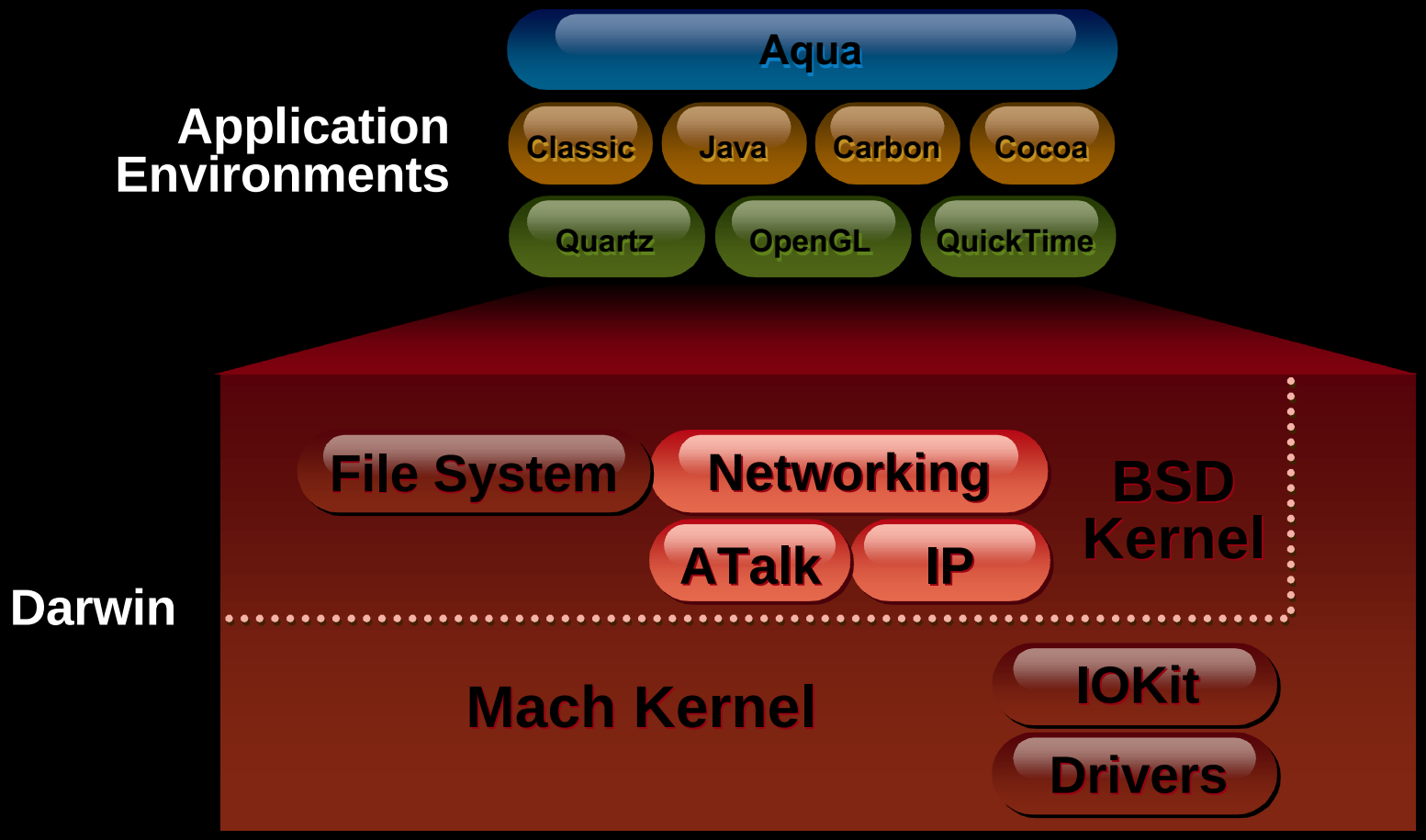
Networking
BSD
Da
BSD with Extensions
Virtual File System
UFS
HFS
NFS
ISO
UDF
Etc.

Networking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Drivers

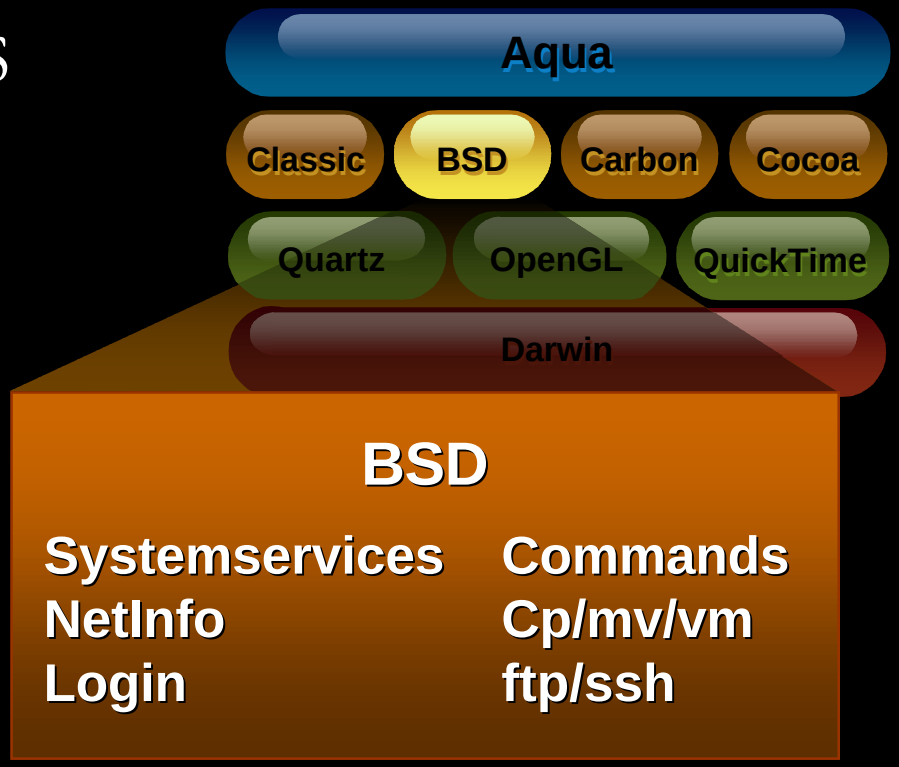
Roadmap

140 The Darwin Kernel

Civic
Fri., 3:30pm

BSD User Environment

- Command line/shells
- Network client tools
  - ssh, finger, ftp
- File tools
  - cp, ls, mkdir
- System tools
  - ps, kill, top, shutdown
- System services
  - NetInfo, DNS/BIND, NTP, syslog, Apache

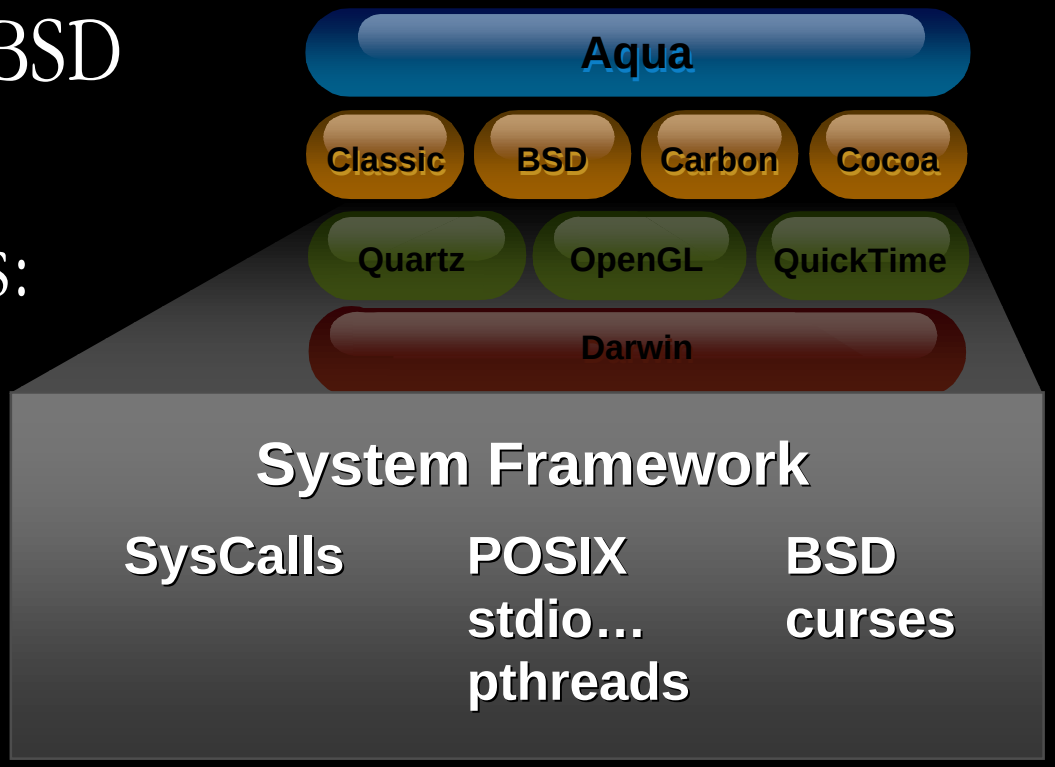


POSIX Applications

- Apache
- Emacs
- Sendmail
- Perl, Tcl, Python
- Samba

System Framework

- Exposes "POSIX"/BSD System APIs
- Additional services:
  - pthreads
  - Math library
  - C library



POSIX?

- Compliance is a goal
- Certification is not a goal
- The BSD API is a first-class citizen in Mac OS X
- Can co-exist with Carbon, Cocoa, and Java
- In fact, application environments build upon these APIs

When Should I Use the BSD API?

- Porting from POSIX
- Portability to POSIX
- When Carbon and Cocoa don't go down far enough
  - Use the highest level of abstraction

Porting From POSIX to Mac OS X

- No X Windows support
  - Can use 3rd-party X servers to help with porting
    - Tenon
    - XFree86
  - Cocoa is usually best choice
  - Carbon can work as well

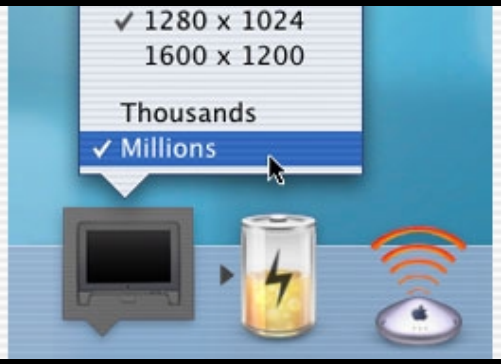
Porting From POSIX to Mac OS X

- Use -fno-common for dylibs
- <mach-o/dyld.h>, not dlopen()
- GNU make is the default
- autoconf usually works
  - powerpc-apple-darwin1.1

Where Things Go…

- /etc
- /bin, /sbin
- /var
- /tmp
- /usr
  - bin, sbin, libexec
  - share
  - lib
- /usr/local

Demo

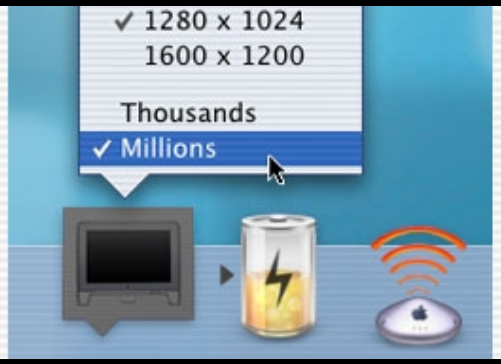


Eric Peyton
Engineer, Core OS Engineering

Why BSD?

- History
  - Tried-and-true
    - NeXTStep, OpenStep, Argon
    - Scalable
    - Robust
  - Well understood
- Open source
  - Active developer and user community

FreeBSD



Jordan K. Hubbard
Founder, Core Team Member, FreeBSD
Darwin Developer

FreeBSD Bundled Sources

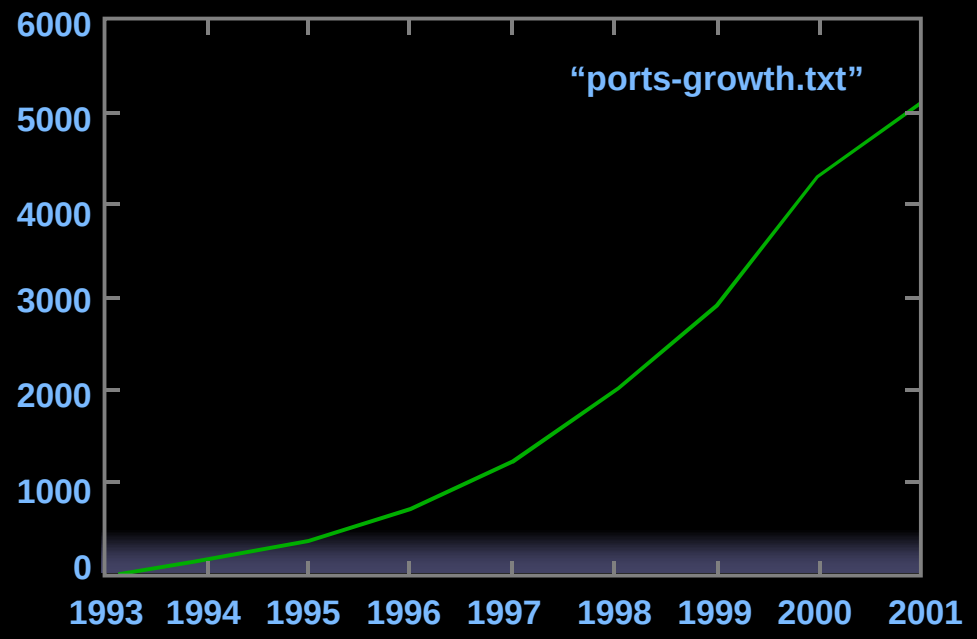
- /usr/src
  - Common Taxonomy
  - Vendor maintained software vs. project maintained software
  - Update, world and kernel targets
- Distributing the bits
  - CVSup: Understands branches and local repos
  - CTM: CVS bits through mail
  - AnonCVS: Standard remote interface
  - CVSWeb: See changes colorfully

FreeBSD Bundled Sources

- The multibranch development model, pros and cons
- Direct benefits to the Darwin community:
  - Userland creature comforts
  - Subsystems and security work
  - Driver reference material

FreeBSD 3rd-Party Apps

- The ports collection
  - Born August 20, 1994—by years end, contained 200 ports
  - 5103 ports in 52 categories today
  - Collection grows at over 50% a year



FreeBSD 3rd-Party Apps

- Standard Body—The OpenPackages project
- Ports collection features:
  - Automated fetch, configure, build, install and package dependency checking and simplistic conflict detection
  - Automated indexing and documentation
  - Binary packages
- What's really great about the ports collection
- What really sucks about the ports collection

The FreeBSD Development Community

- Run by 9 person Core team, elected from and by committers
- 267 CVS committers—docs, src, ports
- “Ownership”—collective vs. individual
- Hearts and minds vs. code—*BSD case studies
- The constantly evolving project identity—what drives it?

Where FreeBSD Can Work With Apple

- Shattering the desktop myth
- Capitalizing on Darwin's freedom to innovate

Wrapping It All Up…

- BSD is a powerful part of Mac OS X
- Avoid user exposure to UNIX
- Leverage Darwin
- Leverage FreeBSD
- Be part of the community

Getting More Information

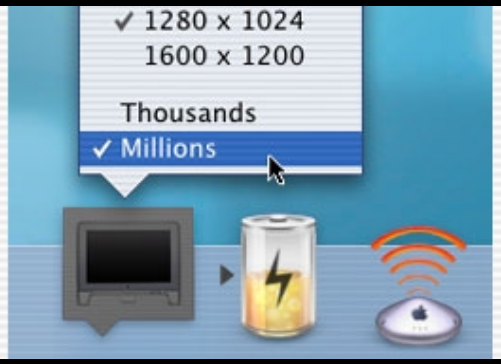
- Darwin
  http://www.opensource.apple.com/
- CAE Specification, Mac OS X/Open 1997
- Design and Implementation of the 4.4 BSD Operating System, McKusick, et. al.
- O'Reilly Books
  http://www.FreeBSD.org
  http://www.NetBSD.org

Roadmap

FF121 Feedback Forum: Darwin

Civic
Fri., 5:00pm

Q&A



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http://developer.apple.com/events/urls.html

WWDC
Worldwide Developers Conference 2001